

BSCS Biology An Ecological Approach

Chapter 8 Heredity and Genetic Variation

It looks like the innovative company, Genetic Savings and Clone, is going out of business. The price for cloning your pet was just too high
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Introduction

Heredity is the passing of **genetic information** from one generation to the next. Simply put, this is why we look (and often act) like our birth parents. There are a number of scientific principles regarding heredity. These were described by biologists and scientists before the invention of powerful scientific tools such as the electron microscope. Using modern chemistry and emerging knowledge, scientists continue to use genetic principles based on evolving research for such processes as genetic engineering.

Genes, DNA, and RNA

Although he could not see them, **Gregor Mendel** identified **genes** as the units of **heredity**. Genes provide a chemical set of instructions for **DNA**. **Messenger RNA** then transmits the genetic information to the **ribosomes** (organelles in each individual cell) where proteins are manufactured. This “manufacturing process” creates the complex and unique organisms of the living world.

Genes, Dominance and Recessiveness

The different forms of the same gene were also identified by Mendel. Known as **alleles**, they are either **dominant** or **recessive**. The dominant alleles are manifested in the **phenotype** of the organism (outward appearance) while the genetic makeup (**genotype**) contains one allele from each parent. Genes are located on **chromosomes**. Each parent contributes one of two **sex chromosomes** and in humans, the sex of the new fetus is determined by the male. Males contribute X or Y chromosomes and females contribute X or X. A combination of XX means female while an XY combination produces a male.

Patterns of Inheritance

Sometimes organisms exhibit **codominance** or **incomplete dominance** which can result in a blending of the genetic characteristics of the parents. **Multifactorial inheritance** involves several genes along with the impact of **environmental factors** to produce a new organism with variable traits. Some traits are X-linked; that is, they are associated with the sex chromosomes. Genes that are located on the same chromosome are said to be **linked**. **Crossing over** is a process in which closely linked chromosomes switch portions of genetic material.

Research and Development

Genetic research is a very important and timely process. The frequency of crossing over between linked genes has allowed scientists to accurately map the locations of genes in many organisms. The **Human Genome Project** has mapped the locations of almost all human genes on the individual chromosomes. This has resulted in a better understanding of human genetic disorders such as **Turner’s syndrome** and **Down’s syndrome**. Proteins can be manufactured by **genetic engineering** while **cloning** makes it possible to produce genetically identical organisms. All of these processes provide good examples of the close relationship between science, technology, and ethical fields of study.